National Aeronautics and Space Administration

NASA's Ecological Eyes in Space

NASA Earth observing satellites are providing measurements for key ecological parameters that are used for research and applications. NASA contributions include studies within terrestrial ecology, land cover and land use change, ocean biology and biochemistry, invasive species monitoring, biodiversity, and ecological forecasting helping us to protect our natural and managed ecosystems.

Tracking and Monitoring Invasive Species

Nonindigenous invasive species may pose the single most formidable threat of natural disaster of the 21st century; causing significant ecological and economic damage throughout the world every year. By combining these data with ground truth data, researchers and resource managers are able to better track and monitor the outbreak, potential spread, and distribution of invasive species.

March 30, 2002

ASTER image (15 m) showing the beginning of an outbreak of hyacinth and hydrilla (red) in the Rio Grande River.

(Image reprinted with permission from M. Jakubauskas, Univ. of Kansas, Lawrence, KS.)

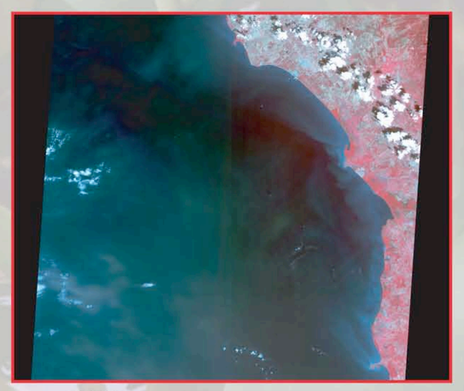
Water Hyacinths Choke the Rio Grande — 2002

From 2001–2002, the Rio Grande was partially blocked by dense mats of water hyacinth and hydrilla. These false color ASTER images demonstrate the ability to use satellite observations for identifying locations of invasive species outbreaks. Healthy vegetation appears red, and water appears black in the river.

May 9, 2002

ASTER image (15 m) showing that over 50% of the river is invaded by hyacinth and hydrilla (red).

(Image reprinted with permission from M. Jakubauskas, Univ. of Kansas, Lawrence, KS.



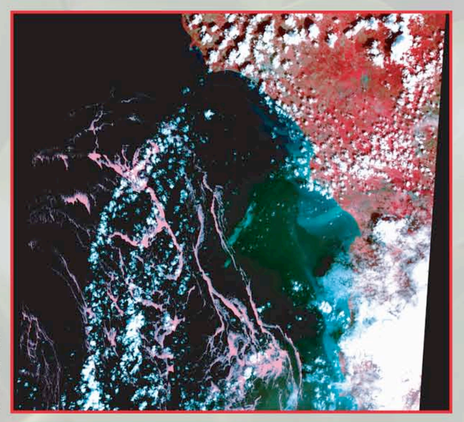
January 26, 2002

ASTER (15 m) image over the southeastern portion of Lake Maracaibo, Venezuela before the invasion of duckweed that started in 2004.

(Image from NASA ESDIS; Data from Land Processes Distributed Active Archive Center)

Duckweed Invades Lake Maracaibo — 2004

During the summer of 2004, 15% of Venezuela's Lake Maracaibo was covered with duckweed wreaking havoc with boat motors. Because it is a major transportation route between the Carribean Sea and the Atlantic Ocean, the government spent up to $2 million per month for removal. Satellite imagery was used to monitor its growth and location to help decision makers responsible for the care and use of the lake.



January 18, 2005

ASTER (15 m) image showing the return of duckweed invasion (red patches in the lake) after is was physically removed in late 2004.

(Image provided by NASA ESDIS; Data from Land Processes Distributed Active Archive Center)

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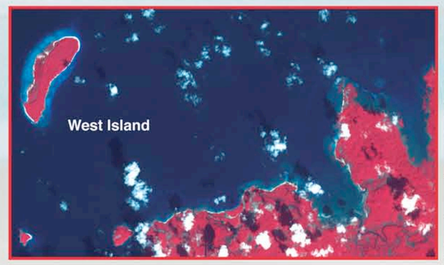
Observations of the 2004 Tsunami

Satellite observations are being used to observe and monitor the horrific damage and massive ecological changes caused by the Sumatra-Andaman earthquake and the resulting tsunami, on December 26, 2004. Damage sustained to the coral reefs, sea grass beds, and mangrove forests cause both short-term and long-term threats to the ecosystem both in preservation of natural resources and economic sustainability.

Coral Reef and Coastal Uplift

The topography of the Andaman Islands was altered by the earthquake, with the western coastline experiencing a 1–2 meter uplift. A number of coral reefs in the uplift area were raised above sea level, (note changes to West Island reefs), impacting the local ecologies.

The waters surrounding the Andaman Islands are home to many species, including the endangered Leatherback turtle. Conservation efforts were drastically impacted when major nesting beaches were flooded or buried under tsunami debris.



December 2, 2004

ASTER image (15 m) of the northern tip of North Andaman Island before the Tsunami.

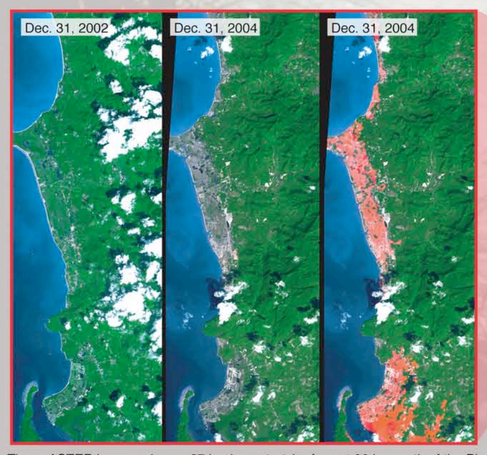
(Image provided by NASA ESDIS; Data from the Land Processes Distributed Active Archive Center)

January 3, 2005

ASTER image (15 m) showing the uplift of the coral reefs and coastal shorelines.

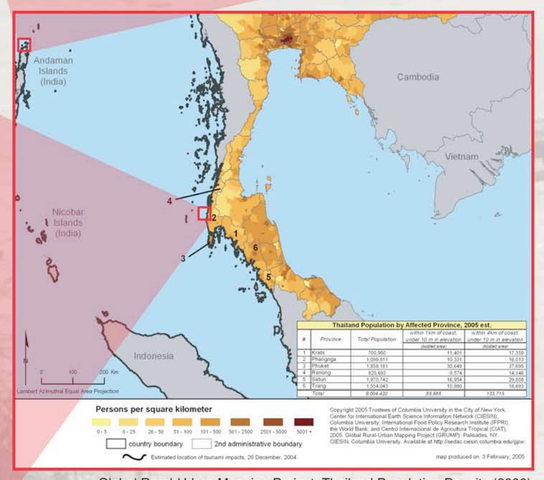
(Image provided by NASA ESDIS; Data from the Land Processes Distributed Active Archive Center)

Coastal Devastation and Human Impacts



These ASTER images show a 27 km long stretch of coast 80 km north of the Phuket airport. The changes along the coast are dramatic with vegetation (green) being stripped away by the force of the waves and inundation (middle). The SRTM data overlay highlights in red (far right) the areas that have an elevation within 10 m of sea level.

(Image Credit: ASTER: NASA/GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team SRTM: NASA/JPL/NGA).



Global Rural-Urban Mapping Project. Thailand Population Density (2000) with population estimates (2005) for Provinces affected by tsunami.

(Image courtesy of SEDAC).

In Thailand, the tsunami hit the coastal region with waves up to 10m high severely impacting six of the country's coastal provinces. Substantial damage was sustained to the tourism industry, fisheries, and agriculture.

Flooding from storms and tsunamis remains a serious threat to these regions. Sea water-and sewage-contaminated surface water pose a lasting danger by dramatically increasing the potential for vector-borne disease. Saline water contamination disrupts the soil, vegetation, and agriculture and can lead to aquatic invasive species outbreaks.